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Techno-Economic Modeling of Cellulosic Biorefineries

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The realization of biofuels at a commercial scale will depend on processes that are energetically, environmentally, and economically sustainable. One main thrust of biofuels research, therefore, has been in techno-economic analysis of biofuel alternatives, which facilitates process design, optimization, and performance evaluation. These studies usually rely on experimentally-derived or assumed parameters to estimate process performance values such as capital and operating costs, GHG emissions, biofuel yield on feedstock, among others. Naturally, the results of the simulations strongly depend on the parameter choices or scenario maps that are considered, which limits the information that the community can extract from the results if only a few instances are outlined. Here, we present a techno-economic model of lignocellulosic ethanol production that is open and transparent and that uses assumptions that reflect technologies that are currently available. Using this model, we have studied how feedstock, enzyme, and strain engineering efforts could potentially affect the economic and performance attributes of the process. The results indicate that pretreatment and hydrolysis yield, inhibition during fermentation, and energy consumption are major factors impacting the economic viability of the process.

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